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CURRENT COTTON GINNING MACHINERY AND PRACTICES

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(Paper presented by the senior author before a meeting of the Cooperative Gin Service and Supply Company, Houston, Texas, March 28, 1941)

This opportunity to acquaint you with the work of the Cotton Ginning Laboratory of the U. S. Department of Agriculture at Stoneville, Mississippi is appreciated. The work consists of ginning research, with its practical applications to the industry, and a continuing close scrutiny of regional ginning requirements and apparatus. Examples of the field investigations which extend to various sections of the Cotton Belt from the Laboratory are regional problem studies, surveys of commercial progress, observations on the practical application by the industry of experimental findings, and follow-ups on latest developments.

In surveying about 100, or two-thirds, of the new gins installed in the Cotton Belt in 1940, it was found that 8 percent replaced in whole or in part former gins which had burned; 44 percent replaced old outfits; and 48 percent were brand new. Of the new gin buildings 3 percent were all-concrete, 15 percent were all-wood, and 34 percent were wooden frames with steel sheeting; the remaining 48 percent were of all-steel modern construction.

It was interesting to observe that while 81 percent of all the presses in these new and replacement outfits were all-steel and 15 percent all-wooden construction, one-third of those in the all-steel group were up-packing and two-thirds were down-packing, showing that the definite trend has been to single-story construction.

In connection with bale packaging, you will be especially interested to know that the Laboratory has completed its first year of experimental high density pressing work at the gin in producing 500-pound bales that are generally comparable in density to compressed bales of standard density. The special experimental cotton bale press was made somewhat heavier and stronger than commercial presses for similar service. It is all-steel and weighs approximately 48,000 pounds, having a high factor of safety in its sills because of the extra strength required to withstand experimental pressures. It has a press box of conventional depth and cross-section (27 x 54 x 114 inches) and uses three hydraulically-operated 9-1/2 inch diameter rams at pressures from 3000 to 4000 pounds per square inch when making 500-pound bales of 24 pounds density. The high pressure pump, which handles from 3 to 16 gallons of oil per minute, can press out a bale in 3 minutes with 35 horsepower, but the Laboratory has proved in recent tests that this power requirement can be reduced to between 20 and 25 horsepower by lengthening the pressing time within practical limits.

It is to be observed that the latest all-steel gin buildings have straight-line roofs and ventilated ridges. The concrete floors are usually elevated somewhat above the ground level and in many cases an outside parapet walk, about 2 feet wide, acts as a wheel curb to protect the building wall. Wagon shelters in most cases run the full length of the building, and bale-platform shelters appear to be used generally over the bale platforms. Overhung shelters appear to be an almost universal practice except where heavy winds or special spans necessitate supporting outboard columns. In a large number of the new buildings the power and fan units are separate from the main ginning compartment. The Laboratory survey showed that 59 percent of the new gins were equipped with internal combustion engines, 4 percent being gas or gasoline engines and 55 percent diesels. Thirty-three percent of the gins were electrically driven and 8 percent used steam power.

In the new gins surveyed the trend in condenser practice, for both airblast and brush gins in the elimination of back-lash and to obtain better cleaning, has been principally to down-draft or side-draft condensers. Only 15 percent of the new gins had up-draft condensers, while 85 were more modern with side- or down-draft units. In the installation of the ginning machinery, feeders, distributors, overhead apparatus and driers, the current set-ups are conspicuously free from superfluous drives and belts. The gin stands are direct-connected with flexible couplings, and this saw-shaft line is then continued as a "stub shaft" to the engine room where fan and other drives are taken off. In many cases V-belt drives predominate with flat-faced pulleys for the drivers and V-groove sheaves on the higher-speed driven elements. This practice, however, is directly reversed in the case of hydrualic pumps, which are being driven from a small grooved sheave on the stub shaft to a single flat-faced large pulley on the pump so that the pump may operate continuously through oversized low-friction piping. Reach-rods from the prime mover clutches, especially in the case of internal combustion engines, are now being carried through the partition bulkhead into the ginning spaces for safety control by the ginner. Volume dampers are now the latest practice on the intakes of fans, and airblast fans are being fitted with water-tube pressure gauges. These gauges should be filled with a liquid containing anti-freeze solution so that the gauge will not be ruined in cold weather. Gin fans, which have heretofore been the profit thieves of the cotton gin, are still in need of a careful check in each installation because the tendency of the erector is almost always to run fans at a speed above what is actually required; in many cases this margin is an unprofitable one. Hull fans should not consume more than 1 horsepower per gin stand; airblast fans not more than 4 horsepower per gin stand; and unloading fans approximately 3 horsepower per gin stand, if one expects to obtain the economies now possible through suitable fan speeds and proper pipe sizes. Pure seed systems, now generally operated by air in combination with self-cleaning belts, are being successfully driven with about 1 horsepower per gin stand when rotary pressure blowers are used with piping approximately 4 inches in diameter. These developments are among the most recent power-saving methods which are actively coming into use.

The saws of modern gins are now usually operated at speeds between 600 and 700 revolutions per minute. Many manufacturers are focusing attention upon improved moting, better seed-roll density control, better huller front action, greater lint turnout and higher capacity.

The studies of variations in gin-saw speed and seed-roll density at the U. S. Cotton Ginning Laboratory in 1940 provided data which indicated that the speeds being employed by the manufacturers on the new gins are optimum, so far as ginning quality and efficiency are concerned. With loose seed rolls, the tests showed that more than a bale per hour per stand could be ginned and that ginning preparation was generally smooth when the cotton was in suitable condition for ginning and when the cotton came to the gin dry or was dried enough through driers to permit smooth ginning. However, even with the newer designs of gins in a good state of repair, and operating with higher saw speeds, dense seed rolls will be the result when the gins are fed beyond normal ginning capacity.

While many of these factory improvements are not applicable to previous models of gins, the Laboratory has proved by tests and practical field operations that the older gins may be so reconditioned and speeded up as to add years of life and improved performance. Two old-style gins were especially tested out after one had been modernized with new saws speeded up to 600 revolutions per minute and with a new brush and suitable cleaner-extractor-feeder. The gin of the same design, which was not rebuilt, operated with a plain drum-feeder, and with saws and brush in an "as is" poor condition, the saws running at 400 revolutions per minute. Modernization not only decreased the ginning time 30 percent, but it added 20 pounds of good fiber to the weight of the bale, on an average throughout the tests; when the two gins were operated at the same capacity, the seed roll of the unmodernized gin so tightened up that it caused much rougher ginning preparation than was accomplished in corresponding ginning on the modernized stand.

It has been pointed out in a number of press releases by the U. S. Cotton Ginning Laboratory that the modernization of the older-style, slower-speed gins, if their frames and general construction are suitable, involves replacement of old bearings with ball bearings, the refilling of the cylinders with approved saws, and the interior reconditioning of the gin stand with relation to dividing boards and other elements. In this modernization the feeder and brush speeds are left unchanged, but in many cases the picker-roller speed is allowed to increase with that of the saws. So, the problem of improving such gin stands is neither complicated nor expensive.

Ginners are finding that changes to increased saw speeds are worthwhile considerations and that they pay dividends comparable to those indicated in the Laboratory investigations. The speed of the gin saws in 9 percent of the 500 commercial gins surveyed by the Laboratory in 1940 was stepped up last fall by an average increase of 102 r.p.m., or from 440 to 542 r.p.m. Of all the gins studied by the Laboratory, including gins in operation from 1 to 20 or more years and averaging 538 revolutions per minute in saw speed, 42 percent were found to employ medium to tight seed rolls with a view to obtaining desired ginning capacity or a satisfactory job of cleaning the seed. On the other hand, of the new gins studied, which averaged 660 revolutions per minute in saw speed, only 4 percent were using dense rolls at the time they were checked by the Laboratory.

Across the entire Cotton Belt the drum type of cleaning feeders is rapidly giving way to individual cleaner-extractor-feeders which may be set into the same space or can be conveniently utilized by merely elevating the distributor. Over two-thirds of the new gins surveyed were equipped with the larger-sized cleaner-extractor-feeders, and the remainder used the conventional or smaller sizes rather than drum-type feeders.

The new distributors which are being installed are almost universally of the screw-conveyor type and above these, in many cases, all-steel overhead cleaners are being installed. Less than 10 percent of the new gins in the Southeastern States had such cleaners, but almost one-half of those in the Mississippi River Valley had them, and all except one of the gins in the West used them along with overhead extractors. The application of hot air to the overhead cleaning and feeding units has produced such an outstanding improvement in their action that one seldom finds new overhead cleaners without some form of cotton drier working in combination with it.

There are many forms of late-model cotton driers, among which are various forms of the government-designed vertical drier, single and double conveyor-distributor driers, drum-cleaner driers, and unit extractor-feeder conditioning systems. Sometimes these are in multiple, so that duplex drying at different temperatures with different volumes can be accomplished in a very flexible manner. The operation of any drier for quality results and economical performance depends upon: (a) safe low temperatures with ample volumes of air per pound of cotton, rather than minimum volumes at unsafe high temperatures; (b) reasonable rates of feed through the drier; and (c) the prevention of repeated passages from the gin overflow through the drier. The degree of moisture removal required for smooth ginning is low and easily accomplished. From a three-year survey of commercial gins across the Cotton Belt, during which the operators of cotton driers cheerfully assisted the Laboratory, it appears that there are now 1340 drier-equipped gins in this country. The 1940 figures showed that about 250 new driers had been installed during that season. During the three-year period, 1938 to 1940, inclusive, an average of more than a million bales of cotton per year has been conditioned by these driers, and 40 percent of the ginnings were reported to have been from green, damp or wet cotton which the driers handled satisfactorily. It has been the concensus of opinion of the operating ginners that their driers gave an average increase of 23 percent in ginning capacity on moist cottons and about 4 percent on dry ones.

Based upon such reports, the bale value was increased by an average of $4.50 with green, damp or wet cotton, and by more than $1 with dry cotton, as a result of conditioning and cleaning the cotton and improving its grade. The fuel costs for all sources of heat averaged 16¢ per bale; they ranged from the high average of 17¢ for steam through an average of 14¢ for furnaces to the low average of 7¢ for engine waste heat recovery outfits. Gas-fired furnaces consuming butane or natural gas have been used in about 50 percent of the 1940 drier installations as compared to an average of 25 percent of the new drier installations during the three-year period.

From the foregoing review of recent cotton ginning machinery installations and practices there seems to have been marked progress in those elements which relate to pressing, actual ginning, drying and seed handling. So much remains to be done, however, with regard to improved cleaning, especially of roughly harvested and machine-picked cottons, preventing power wastes, and obtaining simplified economical installations that we look for remarkable advances in the coming decade.

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